AMENDMENT TO THE CLAIMS

The listing of the claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS

Please amend the claims as follows:

1. (Currently Amended) A method comprising:

exchanging two or more ultrawideband (UWB) signals with one or more target device(s), each device recording a transmission strobe time and a receive strobe time associated with the transmission and reception of such signal(s); ~~and~~

exchanging the recorded transmission strobe time(s) and receive strobe time(s) associated with the exchanged UWB signals from which one or more of a signal propagation time, timing offset and frequency offset are computed; and

computing as a frequency offset between two devices a ratio of the clock frequency of the first device with respect to the second device using the transmission and receive strobe times associated with the exchange of a number (N) of ranging messages, in accordance with the following equation:

$$f_o = \frac{T1_{TA} - T3_{TA}}{T1_{RB} - T3_{RB}} \Rightarrow f_o T1_{RB} - f_o T3_{RB} = T1_{TA} - T3_{TA}$$

where: TN_{TA} is the recorded time of transmit of message N (1…3) at a first device(A);
TN_{RB} is the recorded time of reception of message N at a second device (B); and
f_o is the frequency offset.

2. (Original) A method according to claim 1, further comprising:

computing as the signal propagation time and the timing offset the time delay between the transmission strobe time of an issuing device, and the receive strobe time at the target device.

3. (Original) A method according to claim 2, wherein the signal propagation time is computed after the exchange of at least two messages, M and M', in accordance with the following equation:

$$t_p = \frac{(T'_A - T_A) - (T'_B - T_B)}{2} = \frac{distance}{signal\_velocity}$$

where: T_A is the recorded time of transmit of message M at a first device(A);
T_B is the recorded time of reception of message M at a second device (B):
T'_B is the recorded time of transmit of message M' at a second device (B); and
T'_A is the recorded time of reception of message M' at the first device (A).

4. (Original) A method according to claim 3, wherein the time of reception (T_B, or T'_A) represents the time of transmission, signal propagation delay, and a timing offset between the device(s) (t_o).

5. (Cancelled) A method according to claim 2, further comprising:

computing as a frequency offset between two devices a ratio of the clock frequency of the first device with respect to the second device using the transmission and receive strobe times associated with the exchange of a number (N) of ranging messages, in accordance with the following equation:

$$f_o = \frac{T1_{TA} - T3_{TA}}{T1_{RB} - T3_{RB}} \Rightarrow f_o T1_{RB} - f_o T3_{RB} = T1_{TA} - T3_{TA}$$

where: TN_{TA} is the recorded time of transmit of message N (1...3) at a first device(A);

TN_{RB} is the recorded time of reception of message N at a second device (B); and
f_o is the frequency offset.

6. (Currently Amended) A method according to claim ~~5~~ 1, wherein the number N is four (4).

7. (Currently Amended) A method according to claim ~~5~~ 1, wherein the signal propagation time is computed after the exchange of at least four (4) messages in accordance with the following equation:

$$t_p = \frac{f_o T1_{RB} + T2_{RA} - T1_{TA} - f_o T2_{TB}}{2}$$

where: f_o is the frequency offset identified between the two devices,
$T(N)_{TA}$: is the recorded time of transmit of message (N:1...3) from device (A),
$T(N)_{TB}$: is the recorded time of transmit of message (N:1...3) from device (B),
$T(N)_{RA}$: is the recorded time of receive of message (N:1...3) from device (A), and
$T(N)_{TB}$: is the recorded time of receive of message (N:1...3) from device (B).

8. (Original) A storage medium comprising content which, when implemented by an accessing device, causes the device to implement a method of claim 7.

9. (Original) A method according to claim 1, further comprising:

detecting a transmission strobe time, or a reception strobe time by receiving an analog representation of the message for transmission or upon reception, respectively, and denoting a time when the analog representation of the message exceeds a threshold level.

10. (Currently Amended) An apparatus comprising:

an ultrawideband (UWB) transceiver to transmit and/or receive ultrawideband wireless signals; ~~and~~

a ranging agent, coupled with the UWB transceiver, to exchange two or more ultrawideband (UWB) signals with one or more target device(s), each device recording a transmission strobe time and a receive strobe time associated with the transmission and reception of such signal(s), and to exchange the recorded transmission strobe time(s) and receive strobe time(s) associated with the exchanged UWB signals from which one or more of a signal propagation time, timing offset and frequency offset are computed; and

a frequency offset compensation element, responsive to a control element, to receive transmission and reception strobe times associated with the exchange of a number (N) of messages, and to determine a frequency offset as a ratio of a ratio of the clock frequency of the first device with respect to the second device.

11. (Original) An apparatus according to claim 10, the ranging agent comprising:

a precision timing engine, responsive to a control element, to generate and issue multiple (N) messages via the UWB transceiver, to record the transmission and reception strobe time(s) associated with the exchange of such messages, and to compute one or more of the signal propagation time and the timing offset from which the proximal distance is determined.

12. (Original) An apparatus according to claim 11, the precision timing engine comprising:

a filter, to receive an analog representation of a message and generate a strobe signal once the analog representation of the message reaches a threshold; and

a latch element, coupled with the filter, to transfer an output of a counter to the control element to record the counter output as a strobe time associated with the transmission or reception of the message.

13. (Cancelled) An apparatus according to claim 10, the ranging agent comprising:

a frequency offset compensation element, responsive to a control element, to receive transmission and reception strobe times associated with the exchange of a number (N) of messages, and to determine a frequency offset as a ratio of a ratio of the clock frequency of the first device with respect to the second device.

14. (Original) An apparatus according to claim 13, wherein the frequency offset compensation element determines the frequency offset between the two devices in accordance with the following equation:

$$f_o = \frac{T1_{TA} - T3_{TA}}{T1_{RB} - T3_{RB}} \Rightarrow f_o T1_{RB} - f_o T3_{RB} = T1_{TA} - T3_{TA}$$

where: TN_{TA} is the recorded time of transmit of message N (1...3) at a first device(A);
TN_{RB} is the recorded time of reception of message N at a second device (B); and
f_o is the frequency offset.

15. (Original) An apparatus according to claim 14, wherein the number N of messages exchanged between the devices to ensure that both devices have a complete set of transmission and reception strobe times for both devices is four (4).

16. (Original) An apparatus according to claim 14, wherein the control element determines the propagation delay after the exchange of at least four (4) messages in accordance with the following equation:

$$t_p = \frac{f_o T1_{RB} + T2_{RA} - T1_{TA} - f_o T2_{TB}}{2}$$

where: f_o is the frequency offset identified between the two devices,
$T(N)_{TA}$: is the recorded time of transmit of message (N:1...3) from device (A),
$T(N)_{TB}$: is the recorded time of transmit of message (N:1...3) from device (B),
$T(N)_{RA}$: is the recorded time of receive of message (N:1...3) from device (A), and
$T(N)_{TB}$: is the recorded time of receive of message (N:1...3) from device (B).

17. (Original) An apparatus according to claim 10, further comprising:

control logic, coupled with a memory element comprising executable content, to execute at least a subset of the content to implement the ranging agent.

18. (Currently Amended) A system comprising:

one or more antenna(e);

a wireless transceiver, coupled with the anntena(e), to transmit/receive wireless signals in support of communication between the system and a remote system; and

a ranging agent, coupled with the wireless transceiver, to exchange two or more wireless signals with one or more target device(s), each device recording a transmission strobe time and a receive strobe time associated with the transmission and reception of such signal(s), and to exchange the recorded transmission strobe time(s) and receive strobe time(s) associated with the exchanged wireless signals from which one or more of a signal propagation time, timing offset and frequency offset are computed; and

a frequency offset compensation element, responsive to a control element, to receive transmission and reception strobe times associated with the exchange of a number (N) of messages, and to determine a frequency offset as a ratio of a ratio of the clock frequency of the first device with respect to the second device.

19. (Original) An system according to claim 18, the ranging agent comprising:

a precision timing engine, responsive to a control element, to generate and issue multiple (N) messages via the wireless transceiver, to record the transmission and reception strobe time(s) associated with the exchange of such messages, and to compute one or more of the signal propagation time and the timing offset from which the proximal distance is determined.

20. (Cancelled) A system according to claim 18, the ranging agent comprising:

a frequency offset compensation element, responsive to a control element, to receive transmission and reception strobe times associated with the exchange of a number (N) of messages, and to determine a frequency offset as a ratio of a ratio of the clock frequency of the first device with respect to the second device.